

# ECE 3042

## Spring 2013

### Homework Problem Set 8 for Experiment No. 16

Due Week of April 8

1. In the Common Source amplifier shown below the dc power supply voltages are  $V^+ = +15\text{ V}$  and  $V^- = -15\text{ V}$ . The parameters of the transistor are:  $C_{GDO} = 2.5\text{ nF/m}$ ,  $C_{GSO} = 2.5\text{ nF/m}$ , and  $\lambda = 0.005\text{ V}^{-1}$ . Use the value of  $K$  and  $V_T$  that were measured in Experiment 7 for the N Channel Enhancement Mode MOSFET for which the gate was pin 6, the source pin 7, and the drain pin 8. The circuit resistors are:  $R_1 = R_2 = 180\text{ k}\Omega$ ,  $R_D = 6.8\text{ k}\Omega$ ,  $R_S = 7.5\text{ k}\Omega$ ,  $R_3 = 130\ \Omega$ , and  $R_L = 24\text{ k}\Omega$ . Pick  $C_1 = C_2 = 0.22\ \mu\text{F}$ , and  $C_3 = 10\ \mu\text{F}$ .

Use SPICE analysis to determine the quiescent operating point aka dc operating point aka bias (DC analysis). Use an AC analysis to plot the gain versus the frequency. Choose the lower frequency as 1 Hz and the upper frequency 10 GHz. Mark the midband gain and the  $-3\text{ dB}$  frequencies. The SPICE parameters are KP ( $2K$ ), VTO ( $V_{TO}$ ), LAMBDA ( $\lambda$ ), CGDO ( $C_{GDO}$ ), and CGSO ( $C_{GSO}$ ). If the version of SPICE used requires the width ( $W$ ) and length ( $L$ ) of the channel use  $10\ \mu\text{m}$  for each. Perform a transient analysis to determine the upper and lower clipping levels.

Compare the simulation results with the theoretical predictions.

Compare the lower  $-3\text{ dB}$  frequency with that predicted by Eqn.16-46.

